

NOTIFICATION OF FIRST REASON FOR REJECTION

January 14, 2003

1. Application No. 089116395

International Class: 7th Edition H01L 21/00

2. Title of the Invention:

Processing Apparatus and Processing Method

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5. Filing Date: August 11, 2000

6. Priority: 1 1999/08/13 Japan 11-229338

7. Examiner: Sha Shii

8. Conclusion:

This patent application cannot be granted a patent under the stipulation of Patent Law, Article 20, Section 2.

Note:

1. A technical feature of "Processing Apparatus and Processing Method" of this patent application is to provide a method for removing an oxidized film on a substrate. According to the present invention, two processing chambers are utilized respectively for low-temperature process and high-temperature process. A formation film is formed on an oxidized film on a

substrate in the low-temperature processing chamber, and the substrate is heated in a heating reaction chamber so that the formation film is removed. When executing a high-temperature process and a low-temperature process in the same chamber, a heat for the heating process of the first step influences the low-temperature process of the next step. Thus, the low-temperature process and the high-temperature process cannot be continuously executed with each other until the process chamber is cooled. However, according to the present invention, since a low-temperature process and a high-temperature process are executed respectively in a low-temperature processing chamber and a high-temperature processing chamber, such problem is negated.

2. However, in Publication No. 357424 (attached) entitled "Wafer Processing Machine Vacuum Front End Method Apparatus" published on May 1, 1999, two processing chambers are utilized respectively for a low-temperature process and a high-temperature process so as to negate such problem that the low-temperature process and the high-temperature process cannot be continuously executed with each other until the process chamber is cooled. Comparing both inventions, both solve such problem that the high-temperature and low-temperature processes of a substrate cannot be continuously executed with each other until the chamber is cooled, by executing the high-temperature process and the low-temperature process respectively in two separate chambers. The present invention is different from the citation only in a step to be applied. Further, since the difference is obvious for those skilled in the art, the present invention lacks the inventive step.

As described above, since the present invention does not satisfy a requirement for patent, this patent application cannot be granted a patent under the stipulation of Patent Law, Article 20, Section 2.

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專利名稱: 晶圓加工機器真空前端方法及裝置

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申請專利範圍:

1.一種晶圓加工裝置，包括：

一晶圓加工機，其中具有一主真空室，主室中在環繞一水平軸線之垂直平面中成等角度間隔配置之多個工作站，工作站包括多個加工站及一裝載及卸載站，及可旋轉式安裝於主室內之一分度板，分度板具有環繞水平軸線成角度間隔安裝於其上之多個晶圓架座，故分度板旋轉載送各架座順序通過各工作站，同時將每一架座置於一不同工作站；

一轉移單位，其中具有一真空轉移室，配置於轉移室內之多個處理站，及連通轉移室與晶圓加工機之裝載及卸載站之一裝載反卸載孔；

二晶圓匣裝載閘鎖室，每一室包含支持多個承水平配置晶圓成一垂直疊之裝置，及其內部可選擇性經一可密封孔與轉移室內部連接；

處理站包括：

一晶圓對準站，其上具有建立置於其上之一晶圓之旋轉與偏心對準之裝置，

一晶圓預熱站，其上具有晶圓加熱裝置，

一晶圓冷卻站，其上具有晶圓冷卻裝置，及

一晶圓豎立站，其上包括在轉移室中之一水平方位與在晶圓加工機之裝載及卸載站之一架座之垂直方位間旋轉並載送晶圓通過裝載及卸載孔之裝置；及
轉移室中之一轉移臂，轉移臂能操作而在每一處理站之接納位置與每一裝載閘鎖室拾取及放入一晶圓，並在每一接納位置之間轉移晶圓。

2.一種轉移單位，供用於晶圓加工裝置，加工裝置具有一真空室，其空室內之一裝載及卸載站，裝載及卸載站具有位於其中之固定一晶圓於垂直方位之架座；轉移單位包括：
一真空轉移室：

一可徑向伸出晶圓轉移臂，臂可就轉移室內一垂直軸線樞轉；

多個處理站，約略配置在轉移室內環繞垂直軸線之一平面中；

一裝載及卸載孔，用以連通轉移室與晶圓加工機之裝載及卸載站；

二晶圓匣裝載閘鎖室，每一室包含支持多個水平配置晶圓成一垂直疊之一架，及其內部可藉一可密封孔選擇件連接轉移室；

各處理站包括一晶圓對準站，對準站具有不實際接觸位於其上之晶圓而產生包含晶圓之旋轉及偏心對準資訊之信號之裝置；

各處理站亦包括二段式溫度處理站，此站包括具有晶圓加熱裝置之一預熱段，具有晶圓冷卻裝置之一冷卻段，及在一接納位置與每一段之間移動一晶圓之一活動晶圓支架；

一晶圓豎立站，豎立站包括具有固定一晶圓於其上之裝置之台，台可樞轉式安裝於轉移單位中，以在轉移室中水平平面上之水平方位與在加工機之裝載及卸載站之架座中之垂直方位間擺動並承載一晶圓通過裝載及卸載孔；及

轉移臂包括一可伸出元件，可伸出元件之一端可框轉式連接垂直軸線及其自由端部具有一晶圓接合器，臂可操作而使接合器在每一處理站及每一裝載閘鎖室架之接納位置拾取及放置一晶圓，以及在每一接納位置之間轉移晶圓。

3.一種處理及將晶圓加工之方法，包括下述步驟：

提供多個間隔開之水平方位晶圓，係於至少一匣單位中成垂直疊，該匣單位包含第一匣單位，係於真空環境中與一轉移室連通；

自第一匣單位移送一水平方位晶圓至轉移室中一對準站，並在其上對準晶圓；

自對準站移送已對準晶圓至轉移單位中一預熱站，並將晶圓加熱除氣；

自預熱站移送經除氣晶圓至轉移單位中一豎立站；

自豎立站之水平方位移送晶圓通過一裝載孔至一晶圓加工機之一裝載站之垂直方位；在晶圓加工機中將處於垂直方位之晶圓加工；

自晶圓加工機之裝載站中垂直方位移送已加工晶圓通過裝載孔至豎立站之水平方位；

自豎立站移送晶圓至轉移單位中一冷卻站，並冷卻晶圓；及

自冷卻站移送晶圓至匣單位中之一貯存位置。

4.根據申請專利範圍第3項之方法，其中：

預熱站與冷卻站均位於轉移室中之一預熱及冷卻站；

移送晶圓至預熱站及冷卻站之步驟包括移送晶圓至預熱站及冷卻站之一接納位置，然後自接納位置移送晶圓至相關之加熱站或冷卻站之步驟。

5.根據申請專利範圍第3項之方法，其中：

至少一匣單位進一步包括第二匣單位；及

該方法進一步包括在第一匣單位之晶圓之加工過程中，用多個未經加工晶圓取代第二匣單位中之多個已加工晶圓之步驟。

圖式簡單說明：

第一圖為配有根據本發明之真空前端單位之垂直加工順序旋轉盤式晶圓加工裝置之等角圖。

第二圖為沿第一圖之線2-2所取之頂部平面圖。

第三圖為沿第二圖之線3-3所取之第一圖之第一圖裝置之預熱／冷卻站之側視斷面圖。

專利相關圖形檔：[附圖 1] [附圖 2]

專利相關公告：資料庫中無相關雜文..

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資料來源：智慧財產局

專案執行：A P I P A

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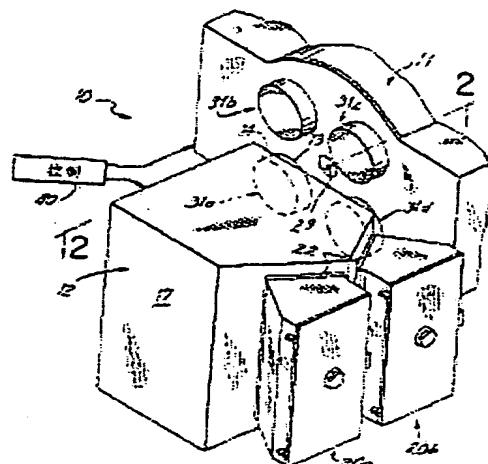
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 資料來源：智慧財產局 專案執行：APIPA

(3)

第一圖



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**WAFER PROCESSING MACHINE VACUUM FRONT END
METHOD AND APPARATUS**

Abstract of the Disclosure:

A carrousel type wafer processing machine in which wafers are held in vertical orientations in holders on a rotatable plate and sequenced through a plurality of processing stations for processing, such as by the application of a sputtered film thereto, is provided with a vacuum front end module that transfers wafers between cassette modules in which the wafers are horizontally disposed and a loading and unloading station of the processing machine, through a transfer chamber. The transfer chamber includes a wafer transfer arm, an aligning station, a preheating and degassing station, a cooling station preferably combined with the preheating station, and an uprighting station from which wafers are exchanged with the processing machine. The arm moves unprocessed wafers individually from a cassette module to the aligner, then to the preheating station, then to the uprighting station. The arm also moves processed wafers from the uprighting station, to the cooling station and to a cassette module. Preferably, one cassette module is being vented, reloaded or replaced, and pumped to a vacuum while the wafers of the other are being cycled through the processing machine.

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WAFER PROCESSING MACHINE VACUUM FRONT END
METHOD AND APPARATUS

5 The present invention relates to the processing of wafers such as semiconductor wafers, and, more particularly, to pre and post processing handling and treatment of wafers in a vacuum between wafer cassette modules and a multistation wafer processing machine.

Background of the Invention:

10 In the processing of semiconductor wafers, processes such as sputter coating processes for the deposition of films, such as films of aluminum, are employed. Such processes are often carried out in machines such as, for example, that disclosed in U.S. Patent No. 4,909,695, assigned to the assignee of the present application, and expressly incorporated by reference herein. In such machines, wafers are individually introduced from an external atmosphere, through a loadlock onto one 15 of a plurality of wafer holders in a vertically disposed circular plate, and then moved, by rotating the plate about a horizontal axis, to index it sequentially through a plurality of

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processing stations in which a series of process steps are performed carried out. Such steps may include, for example, sputter etching and sputter coating steps such as those that result in application of an aluminum coating to the wafers.

5

Typically, throughput for such a machine is slightly more than one minute per wafer for deposition of a one micron film of aluminum.

10

In introducing the wafers from the external atmosphere, inevitably some particulate or other contamination is introduced into the internal environment of the processing machine. Ideally, introduction of such contaminants should be totally prevented or at least kept at a minimum, as each particle or contaminant can result in a defective device on the wafer and thus reduce the ultimate value of the wafer.

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Further, in such a processing machine, the performance of an initial preheating or degassing step is desirable. Such a step may be performed in the loadlock of the machine, and provision therefore has been made by a backplane heater in the apparatus disclosed in the patent incorporated above. In the loadlock chamber after being introduced from the external atmosphere, such degassing to drive off water vapor from the wafer is of limited effectiveness. Unremoved gases are a

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potential process contaminant that can also adversely affect the quality of a deposited film.

The processing of a wafer to produce completed semiconductor devices involves more processes than are performed in machines of the type referred to above. Some processes are performed before, and others after, introduction of the wafers into such a machine. The transporting of wafers between machines often results in contamination or deterioration of the wafers by exposure to atmosphere. With wafers coated with titanium-tungsten (TiW) films, for example, their exposure to ambient atmosphere before or after a subsequent coating cycle allows oxygen to contact and affect the TiW film, causing metallurgical change, introducing stress in the TiW film, or causing the film to fracture and flake.

In the processing of wafers described above, there is a need to increase the throughput of the wafer processing equipment, particularly equipment of the vertical carrousel type described in the patent incorporated above, and to reduce and remove contaminants from the process performed in the apparatus.

In the commonly assigned and copending U.S. Patent application Ser. No. 07/701,800, entitled WAFER PROCESSING CLUSTER TOOL BATCH

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PREHEATING AND DEGASSING METHOD AND APPARATUS,
expressly incorporated herein by reference, further
needs for pre and post processing handling and
treating of wafers, and for the interfacing of
5 processing equipment with standard wafer cassette
modules are set forth. In such cassette modules,
wafers are horizontally oriented in a vertical
stack in a plastic rack, and the modules are each
sealed to a port of a transfer module and pumped to
10 a vacuum before opening the port. The pumping of
one such module typically takes more than ten
minutes. Such modules may also be sealed with
wafers enclosed therein and moved from machine to
machine.

15 There is a particular need to efficiently
and effectively interface wafer processing
equipment, particularly of the vertical carrousel
type, with such cassette modules in a way that will
optimize the use of the coating machine.

20 Summary of the Invention:

A primary objective of the present
invention is to provide a wafer processing machine,
particularly a serial or sequential vertical wafer
processing machine, for example of the carrousel
25 type, with vacuum front end unit or module that is
capable of rapidly transferring wafers to and
from a single access port of the vertical

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processing machine from and to multiple wafer sealable cassette modules, particularly those in which in which the wafers are horizontally disposed, while maintaining isolation of the wafers 5 from external atmosphere and thereby minimizing contamination.

It is a further objective of the present invention to provide a wafer pretreatment and post treatment capability, particularly for the 10 preheating or degassing of wafers prior to processing in the apparatus and for the post processing cooling of the wafers to expedite their return to a cassette module.

According to the principles of the present invention, a vertical sequential wafer processing machine is provided with a vacuum front end module having ports connecting to an inlet port of the apparatus and to a cassette loadlock port at which wafers are horizontally disposed. The module is 15 preferably provided with a pair of inlet/outlet ports for connecting to a pair of standard wafer cassette modules that are sealable and evocable so as to serve as loadlocks for the front end module, which can be maintained at a vacuum pressure level 20 and of the same atmosphere of the processing apparatus.

In the preferred embodiment of the

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invention, the vacuum front end module functions as
a transport module and contains therein a robot
transfer assembly having an arm that is rotatable
about a fixed axis and is extendable radially from
the axis. Disposed within the transport module
around this axis are a plurality of stations,
including a wafer aligning station, a combined
preheating/degassing and cooling station, and an
uprighting station. Each of these stations
includes a wafer receiving position in approximate
horizontal alignment with a plane of the transfer
arm so that the arm can deliver wafers to and
receive them from each station by rotation of the
arm about the axis and extending and retracting the
arm and raising the arm above and lowering the arm
below the plane. Each of the cassettes is also
positioned so as to be similarly accessible by the
transfer arm. The transfer arm is preferably of a
frogleg type, having a pair of hinged two section
extendable members linked together, such as
disclosed in U.S. Patents Nos. 4,666,366, 4,730,976
and 4,909,701.

The arm has two vertical positions
including a raised and a lowered position. At the
lowered position, the arm moves into and out of
slots of the cassette modules to load and unload
wafers therefrom. Racks in the cassette modules

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move vertically to present each of the wafer holding slots thereof selectively in line with this lowered arm position. At the raised position of the arm, the arm moves to and from the other stations of the module to position wafers just above the wafer receiving positions of the stations that are in approximate horizontal alignment with the lowered position of the arm, so that the arm can load and unload wafers to and from the station's receiving positions by respective downward and upward movement between the two vertical positions of the arm.

The aligning station preferably includes a non-contacting sensor, such as an LED and CCD array combination spaced respectively above and below the wafer receiving position at which a wafer is placed by the arm onto a rotatable support made of, for example, set of pins or a support table. The table rotates and the sensor detects the position of the edge of a wafer supported thereon with respect to an axis of rotation thereof and as a function of angular position. Detected wafer edge position data is processed by a microprocessor to determine the effective center of the wafer and the location of a fiducial mark such as a reference notch or flat on the wafer edge. Information thereby generated by the microprocessor is used to control

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the transfer arm to perform what is referred to as
a "delta pick-up", which compensates for any
rotational or eccentricity misalignment, so that
the wafer, when returned to the arm, is in a
precisely known centered and oriented location with
respect to the arm.

The preheating and cooling station
preferably includes a support moveable between a
heating position above the wafer receiving position
and a cooling position below the wafer receiving
position. At the heating position, the wafer is
heated by a set of radiant lamps positioned at the
top of the station and at the cooling position the
wafer is cooled by, for example, vacuum clamping
the wafer to a cooled surface at the bottom of the
station.

The uprighting station preferably includes
a wafer support platen at the receiving position of
the uprighting station. The platen is carried on
one end of a wafer uprighting arm that is pivotally
supported at other end about a horizontal pivot
axis. The pivot axis is generally parallel to the
vertical plane of a holder of the processing
apparatus. The arm is generally centered on a
vertical plane perpendicular to and through the
center of the holder at an inlet/outlet port of the
processing apparatus, so that, by 90° rotation of

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the arm, the platen is moved from a horizontal wafer supporting orientation at the receiving position at the uprighting station to a vertical orientation at the holder in the inlet/outlet port of the processing apparatus. The platen includes clamping means, such as clips or a vacuum chuck, for holding a wafer to the platen so that it can be moved between the holder of the apparatus and the receiving position of the uprighting station.

In operation, the apparatus equipped with the vacuum front end according to the principals of the present invention provides advantages of efficiency and reduced contamination of the wafers being processed. Wafers are presented to one of the inlet/outlet ports of the module in a first sealed cassette, isolated from the surrounding atmosphere. While wafers in a second cassette module are being processed, the first cassette is evacuated, whereby the processing time of the equipment is not interrupted during such pumpdown. Wafers may be loaded and unloaded to and from the cassette through a load lock door therein, or the entire cassette modules may be sealed and exchanged, with the wafers sealed therein, so the wafers can be transported between machines without exposure to ambient atmosphere.

Once the first cassette is evacuated, a

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gate between the cassette and module is opened and the elevator within the cassette sequentially presents the wafers individually to a transfer position vertically aligned in the horizontal plane of the lowered position of the transfer arm. The arm extends and removes the wafer at the transfer position by retracting from the cassette and then raises, rotates and lowers to place the wafer at the receiving position at the aligning station.

When the alignment data is collected by the sensor of the aligner, the arm picks up the wafer from the aligner, properly aligned by arm movements responsive to the alignment data, and similarly places the aligned wafer at the receiving position of the preheating and cooling station on a support. The support then lifts the wafer and the lamps are energized, thereby degassing the wafer. From the preheating station, the wafer is then similarly moved by the transfer arm to the platen of the uprighting station, to which it is clamped and then tilted to a vertical orientation at which it is placed in the holder at the of in the inlet/outlet port of the processing apparatus.

This wafer is then carried to the first processing station of the processing apparatus by rotation of an index plate therein that carries the holder. This rotation brings a processed wafer

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from the last station within the processing apparatus into the inlet/outlet port.

From the inlet/outlet port of the processing apparatus, a processed wafer is picked up by the platen in its vertical orientation and lowered and rotated to a horizontal orientation at the receiving position of the uprighting station, where it is picked up by the transfer arm and transferred to the preheating and cooling station.

At the preheating and cooling station, the processed wafer is lowered to the cooling position at which it is vacuum clamped onto a cooled support and rapidly cooled to a temperature at which it can be placed into a standard plastic wafer supporting rack in a cassette module, for example the first cassette, to which it is then directly transferred by the transfer arm.

During the processing of wafers from, and reloading wafers to, the first cassette, the second cassette is exchanged to bring a fresh set of unprocessed wafers to the apparatus, and the second cassette is pumped to the vacuum level of the module. The gate to the first cassette is then closed and the gate to the second cassette is opened. Also, the movements of wafers incident to the exchange of processed and unprocessed wafers at the input/output port of the machine, and the pre

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and post processing treatment thereof, takes place during a machine process cycle without delay of the machine or other loss of processing time.

The combination and procedure outlined
5 above provides for fast efficient and continuous throughput of wafers to the carrousel type wafer processing apparatus, while retaining the wafers in an clean atmosphere isolated from ambient atmosphere. It also provides for effective and
10 efficient preheating and post processing cooling of the wafers, alignment of the wafers to prevent damage thereof, and change of attitude, between horizontal and vertical, to interface with corresponding equipment.

15 These and other objectives and advantages of the present invention will be apparent from the following detailed description of the drawings in which:

Brief Description of the Drawings:

20 Fig. 1 is an isometric diagram of a vertical processing sequential carrousel type wafer processing apparatus equipped with a vacuum front end module according to principals of the present invention.

25 Fig. 2 is a top plan view taken along the line 2-2 of Fig. 1 illustrating the apparatus of Fig. 1.

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Fig. 3 is a side cross sectional diagram of the preheating/cooling station of the apparatus of Fig. 1 taken along the line 3-3 of Fig. 2.

Detailed Description of the Drawings:

Referring to Figs. 1 and 2, a wafer processing apparatus 10 is illustrated that includes a carrousel type wafer processing machine 11 equipped with a vacuum front end module 12. The machine 11 is, for example, of the type described in U.S. Patent No. 4,909,695, referred to above, and incorporated by reference herein. The machine disclosed in this patent is modified to eliminate the wafer handling front end disclosed in the patent in Figs. 4 through 15B thereof, which is replaced with the module 12 described herein. The loadlock door of the machine disclosed in this patent has also been removed to form an inlet/outlet port 13, which connects to a corresponding machine interface port 14 of the module 12, and permanently communicating the vacuum atmosphere of the interior 15 of the module 12 with that of that of the main chamber 16 of the processing apparatus 11. This permanent connection is practical with the machine of the patent in that each of the processing stations therein is separately isolatable from the main chamber 16. Without such separate isolation feature, other

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means would be preferred to prevent the processes within the apparatus from propagating contaminants into the module 12.

The module 12 is equipped with a closed housing 17 which is provided with two cassette loading and unloading ports 18, illustrated as 18a and 18b, to which are connected two cassette carriers 20, illustrated as 20a and 20b, respectively. The cassette carriers 20 are conventional cassette modules having a gate 21 that allows for the sealing of the port 22 thereto when cassette modules 20 are exchanged. The transport module 12 is also provided with a gate valve 19 to seal each of the ports 18 therein when the cassette modules 20 are changed. The port 22 of the modules 20 sealably connects to a respective one of the ports 18 of the module 12 so that the gate valves 19 and 21 can be opened to pass wafers therethrough while under vacuum. This is better illustrated in Fig. 2.

Referring to Fig. 2, interior 15 of the front end module 12 is illustrated surrounded by the housing 17. The machine interface port 14 is an opening in the housing 17, which opening is surrounded by a seal 25 that seals the housing 17 to a machine housing 26 that encloses the main chamber 16 of the machine 11, thereby aligning the

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opening with the inlet/outlet port 14 of the machine 11.

In the main chamber 16 of the machine 11 is an index plate 28, rotatable about a horizontal axis 29, containing a plurality wafer holders 30, for example four in number, spaced at equal circumferential intervals about the axis 29 to align with a corresponding plurality of stations 31, illustrated as 31a-31d, in Fig. 1. The stations 31b-31d are processing stations, such as sputter coating and sputter etching stations, and the station 31a is a loading and unloading station to which access is provided by the port 14. Because the module 12 is connected to the inlet/outlet port 14 of the machine 11, an access door 33 is provided for the servicing of the holder 30.

As illustrated in Fig. 2, the module 12 includes the two cassette modules or loadlocks 20a,20b, a frogleg robot arm 40, a wafer aligner 41, a preheating and cooling station 42 and an uprighting mechanism 43.

Each of the loadlocks or cassette modules 20 includes a standard wafer elevator rack 45 in which are typically carried a set of twenty-five horizontally disposed and vertically spaced wafers 46. The racks 45 move vertically in the loadlocks

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20 to bring each of the wafers selectively into alignment with a horizontal transfer plane of the module 12.

5 The transfer arm 40 includes a wafer gripper 48 at the end of extendable hinged members 49. The arm 40 is rotatable about a vertical transfer axis 50 and is moveable axially in a vertical direction between a lowered position in the horizontal transfer plane of the module 12 and a raised position slightly thereabove. The 10 grippers 48 are moveable radially toward and away from the axis 50 by operation of the extendable members 49 of the arm 40.

15 The wafer aligner 41 a rotatable wafer support 51 formed of the upper ends of three pins 52, which lie in the horizontal transfer plane of the module 12 and onto which a wafer is placed by the gripper 48 of the arm 40. The aligner 41 includes a LED source 53, positioned above the 20 transfer plane, and a CCD receiver (not shown) spaced directly below the LED 53 below the transfer plane. On the table 51 a wafer is rotated and the position of its edge is sensed to generate data to be interpreted by a microprocessor to control 25 movements of the arm 40 that compensate for rotational and off-center misalignment of the wafer.

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The preheating and cooling station 42 is best illustrated in Fig. 3 which shows the components thereof positioned relative to the horizontal transfer plane 55. A vertically moveable wafer support table in the form a ring shaped poppet 56 is shown in an upper position. From this position, the poppet 56 is lowered into alignment with the plane 55 to receive a wafer from the transfer arm gripper 48, which will move into the station 42 by extension of the frogleg members 49 while the transfer arm 40 is in the raised position above the plane 55. When the gripper 48 is above the poppet 56, the arm 40 lowers the wafer 46 thereon.

When the wafer 46 is on its way to the processing machine 11, the preheating and cooling station 42 is used to heat and degas the wafer. After processing, the wafer is cooled in the station 42. To provide the preheating function, a degassing section is provided at the top of the station 42, which includes a bank of infrared radiant heat lamps 58 positioned above a quartz window 59 at the top of the station 42. For heating of wafers 46, the poppet 56 is moved upward from the plane 55 to that illustrated in Fig. 3 to support the wafer at a degassing position 61 near the window 59.

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To provide the cooling function, a cooling section 62 is provided at the bottom of the station 42, which includes platen 63. The platen 63 is cooled by cooling liquid that flows through ports therein (not shown). The platen 63 is provided with vacuum hold down means for clamping a wafer thereto for cooling in a position 65 against the upper surface thereof. The wafer on the ring shaped poppet 56 is placed at the cooling position 65 by downward movement to a position where it surrounds the platen 63. The poppet 56 is raised and lowered by a pneumatic cylinder 66 in the base of the station 42.

The uprighting station 43 is provided with a wafer supporting platen 70 mounted to the free end of an uprighting lever 71 that is pivotally supported to swing in a 90° arc about a horizontal axis 74 that is parallel to a vertical plane 75 that contains the index plate 28 of the processing machine 11. The lever 71 swings from a horizontal position at which the platen 70 has a wafer supporting surface facing upwardly at a wafer receiving position in the transfer plane 55 to a vertical position at which the surface of the platen 70 and a wafer thereon is transferred to or received from the holder 30 at the port 14 of the machine 11. In the horizontal receiving position,

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the platen 70 receives a wafer from or presents a wafer to the gripper 48 of the transfer arm 40. The platen 70 is provided with clamp structure such as a set of three lock rollers 77 to grip the wafer on the platen at its edge and hold it thereto for uprighting to the port 14 or lowering to the plane 55.

5 The operation of the machine 11 and of the module 12 are controlled and coordinated with by 10 software in a programmable controller 80 connected to the operating elements of the apparatus 10.

15 Only one embodiment of the invention has been herein described, but those skilled in the art will appreciate that various additions, alternatives or modifications to that described may be employed without departing from the principles of the present invention. Accordingly, what is claimed is:

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1. A wafer processing apparatus comprising:

a wafer processing machine having a main vacuum chamber therein, a plurality of workstations disposed at equal spaced angular intervals in a vertical plane around a horizontal axis in the main chamber, the plurality of workstations including a plurality of processing stations and a loading and unloading station, an index plate rotatably mounted in the main chamber and having a plurality of wafer holders mounted thereon at angular intervals about the horizontal axis such that the plate rotates to carry the holders sequentially through the workstations and to simultaneously position each of the holders at different ones of the workstations;

15 a transfer module having a vacuum transfer chamber therein, a plurality of treatment stations disposed in the transfer chamber, and a loading and unloading port communicating between the transfer chamber and the loading and unloading station of the wafer processing machine;

20 two wafer cassette loadlock chambers each containing means for supporting a plurality of horizontally disposed wafers in a vertical stack therein, and having an interior selectively connectable through a sealable port to the transfer chamber of the transfer module;

25 the treatment stations including:

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30 a wafer aligning station having
means thereat for establishing rotational and
eccentrical alignment of a wafer positioned
thereat,

a wafer preheating station having
wafer heating means thereat,

35 a wafer cooling station having wafer
cooling means thereat, and

40 a wafer uprighting station including
means thereat for rotating a wafer thereat and
carry the wafer through the loading and
unloading port between a horizontal
orientation in transfer chamber to a vertical
orientation in a holder in the loading and
unloading station of the wafer processing
machine; and

45 the transfer arm in the transfer chamber
is operable to pickup a wafer from, and deposit the
wafer at, a receiving position at each of the
treatment stations and in each of the loadlock
chambers and to transfer wafers among each of the
receiving positions.

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2. A transfer module for a wafer processing apparatus having a vacuum chamber therein, a loading and unloading station in the vacuum chamber having a holder located therein for holding a wafer in a vertical orientation, comprising:

a vacuum transfer chamber;

a radially extendable wafer transfer arm pivotal about a vertical axis within the transfer chamber;

a plurality of treatment stations disposed approximately in a horizontal plane about the vertical axis in the transfer chamber;

a loading and unloading port communicating between the transfer chamber and the loading and unloading station of the wafer processing machine;

two wafer cassette loadlock chambers each containing a rack for supporting a plurality of horizontally disposed wafers in a vertical stack therein, and having an interior selectively connectable through a sealable port to the transfer chamber;

the treatment stations including a wafer aligning station having means thereat for generating signals containing information of rotational and eccentric alignment of a wafer

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positioned thereat without physically contacting the wafer;

the treatment stations also including a two section temperature treatment station, including a preheating section having wafer heating means thereat, a cooling section having wafer cooling means thereat, and a moveable wafer support for moving a wafer between a receiving position and each of the sections;

a wafer uprighting station including a platen thereat having means for holding a wafer thereto, the platen being pivotally mounted in the transfer module to swing, and carry a wafer, through the loading and unloading port between a horizontal orientation in the horizontal plane in the transfer chamber to a vertical orientation in the holder in the loading and unloading station of the machine; and

the transfer arm including an extendable member pivotally connected at an end thereof at the vertical axis and having a wafer engager at a free end thereof, the arm being operable to engage a wafer with the engager and pickup the wafer from, and deposit the wafer at, a receiving position at each of the treatment stations and in each of the racks of the loadlock chambers, and to transfer wafers among each of the receiving positions.

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3. A method of handling and processing wafers comprising the steps of:

providing a plurality of horizontally oriented wafers spaced in a vertical stack in at least one cassette module, including a first cassette module, in a vacuum environment in communication with a transfer chamber;

5 moving a horizontally oriented wafer from the first cassette module to an aligning station in the transfer chamber and aligning the wafer thereat;

10 moving the aligned wafer from the aligning station to a preheating station in the transfer module and heating the wafer to degas the wafer;

15 moving the degassed wafer from the preheating station to an uprighting station in the transfer module;

20 moving the wafer from a horizontal orientation at the uprighting station through a loading port to a vertical orientation in a loading station in a wafer processing machine;

25 processing the wafer while in the vertical orientation in the wafer processing machine;

moving the processed wafer from the vertical orientation in the loading station of the

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wafer processing machine through the loading port
and to a horizontal orientation at the uprighting
30 station;

moving the wafer from the uprighting
station to a cooling station in the transfer module
and cooling the wafer thereat; and

35 moving the wafer from the cooling station
to a storage position in the cassette module.

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4. The method of claim 3 wherein:

the preheating station and cooling station are located in the transfer chamber at a preheating and cooling station;

5 the steps of moving the wafer to the preheating station and the cooling station include the step of moving the wafer to a receiving position at the preheating and cooling station and then moving the wafer from the receiving position to the respective heating or cooling station.

10 5. The method of claim 3 wherein:

the at least one cassette module further includes a second cassette module; and

5 the method further comprises the step of replacing a plurality of processed wafers in the second cassette module with a plurality of unprocessed wafers while wafers from the first cassette module are being processed.

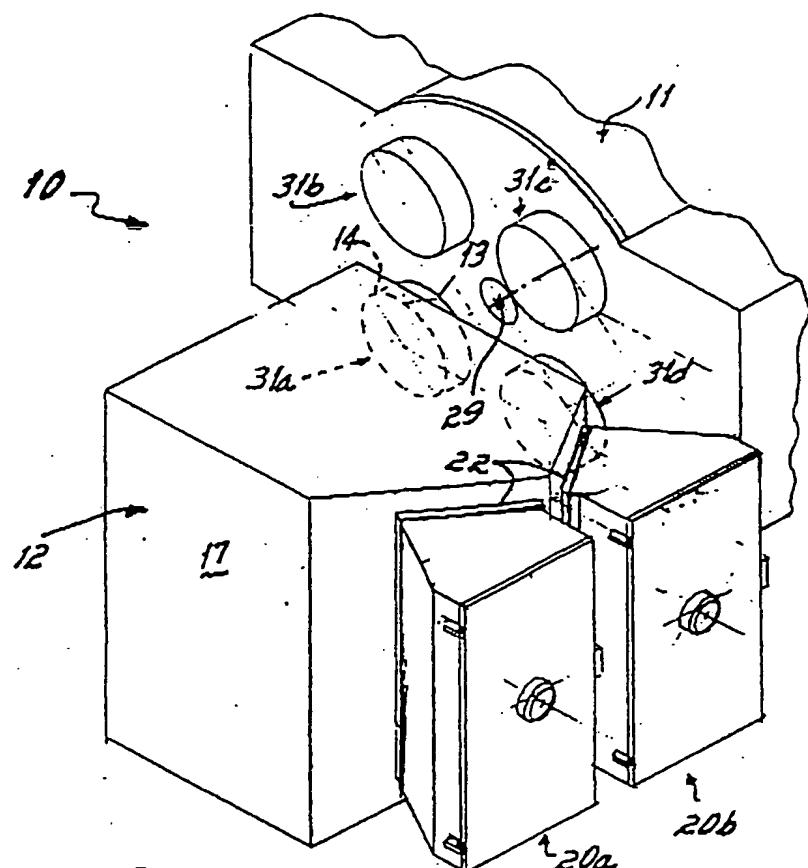


FIG. 1

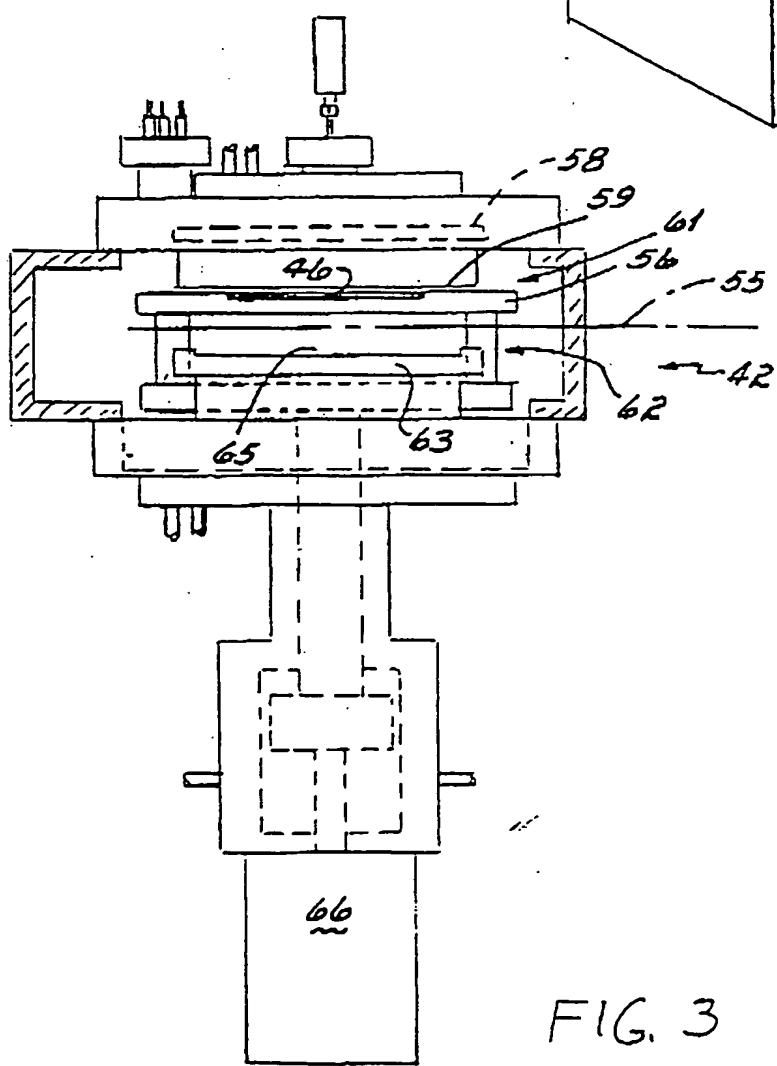


FIG. 3

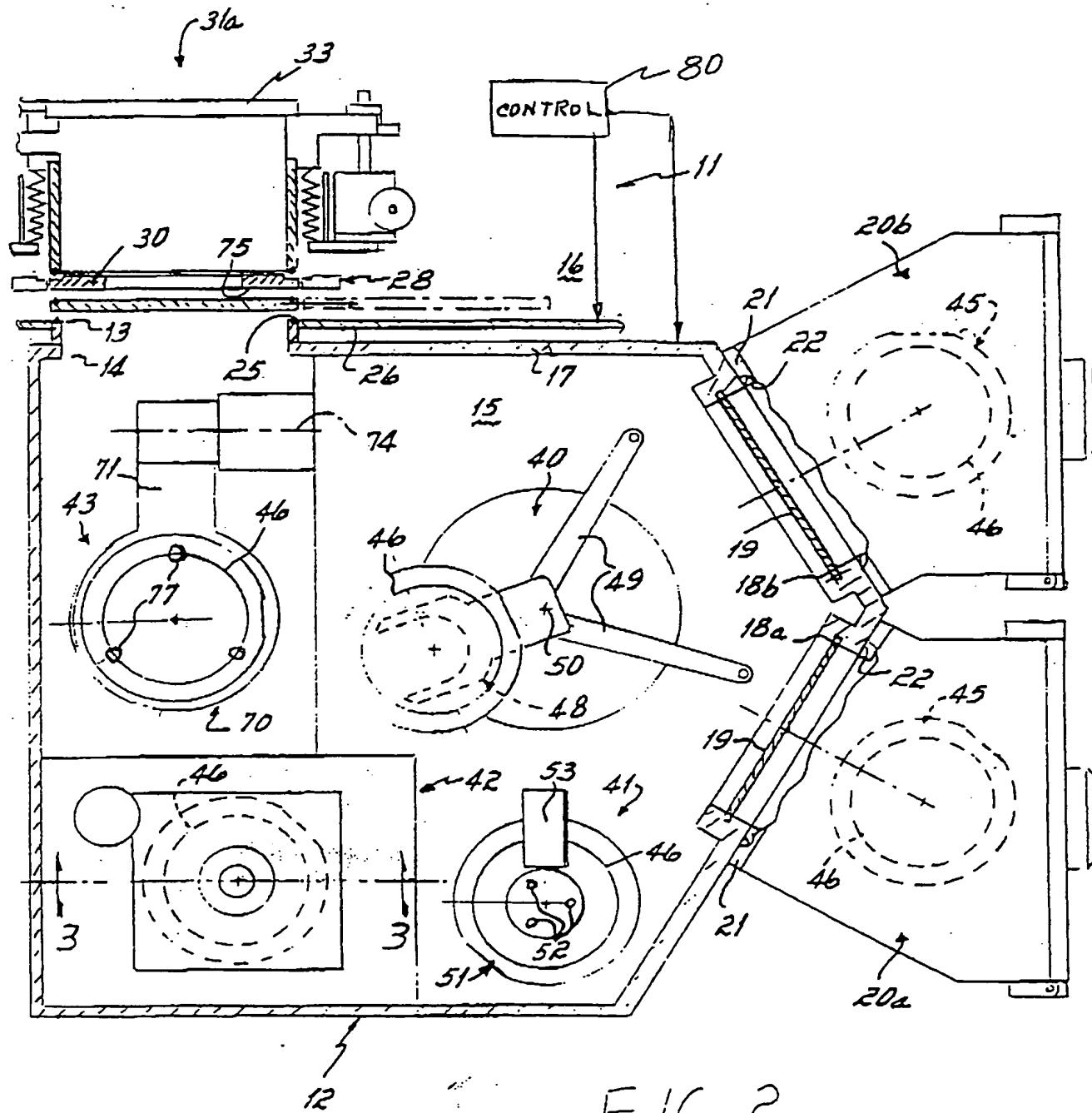


FIG. 2

經濟部智慧財產局專利核駁審定書

受文者：東京威力科創股份有限公司（代理人：
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發文日期：

中華民國九十二年一月十四日

發文字號：（九二）智專二（一）04066字

第〇九二二〇〇二四五〇〇號

一、申請案號數：〇八九一一六三九五

二、發明名稱：處理裝置及處理方法

三、申請人：

名稱：東京威力科創股份有限公司

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複代理人：

五、申請日期：八十九年八月十一日

專利分類IPC(7)……H01L 21/00

(5.9)
2.12



六、優先權項目：

1 1999/08/13 日本11-229338

七、審查人員姓名：謝志偉 委員

八、審定內容：

主文：本案應不予專利。

依據：專利法第二十條第二項。

理由：

(一) 本案「處理裝置及處理方法」主要技術特徵係提供一種基板除去氧化膜的方法，利用兩處理室分別進行低溫與高溫處理，於低溫處理室反應中在基板氧化膜上反應形成生成膜，再於加熱反應室中加熱去除該生成膜，藉由利用低溫與高溫處理室分別進行低溫與高溫處理，可以避免同一製程室時存在著前一階段加熱處理之熱會對下一階段於低溫中進行之反應產生妨礙，而無法交互地連續進行低溫處理與熱處理。

(二) 如民國八十八年五月一日公告之中華民國專利公告編號第三五七四二四號案「晶圓加工機器真空前端方法及裝置」所揭示（引證附件），利用兩處理室分別進行低溫與高溫處理，可以避免需費時等待反應室冷卻的問題無法交互地連續進行低溫處理與熱處理。相較兩案可知，兩案均係將高溫與低溫製程分別由兩處理室個別進行低溫與高溫處理，以避免因費時等待反應室冷卻的問題而無法交互地連續進行基板處理，本案與

引證案之差異處僅在於應用製程不同，且此差異處能為熟悉該項技術者所能輕易完成，故不具進步性。

據上論結，本案不符法定專利要件，爰依專利法第二十條第二項，審定如主文。

局長蔡練生

依照分層負責規定授權單位主管決行

如不服本審定，得於文到之次日起三十日內，備具再審查理由書一式二份及規費新台幣陸仟元整（專利說明書及圖式合計在五十頁以上者，每五十頁加收新台幣五百元，其不足五十頁者以五十頁計），向本局申請再審查。